Title: CONTROLLER FOR CONTROL AT ENGINE STARTUP
Inventor(s): Takashi ISE
Serial No.: Unknown
Docket No.: Saigoh Case 313

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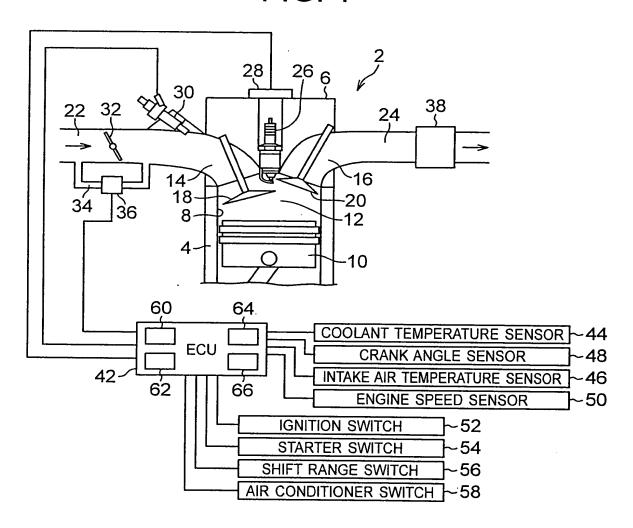
FIG. 1

COOLANT TEMPERATURE SENSOR	~44
CRANK ANGLE SENSOR	~48
INTAKE AIR TEMPERATURE SENSOR	~46
ENGINE SPEED SENSOR	~50
IGNITION SWITCH	~52
STARTER SWITCH	~54
SHIFT RANGE SWITCH	~56
AIR CONDITIONER SWITCH	~58

FIG. 2

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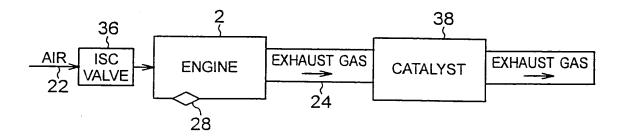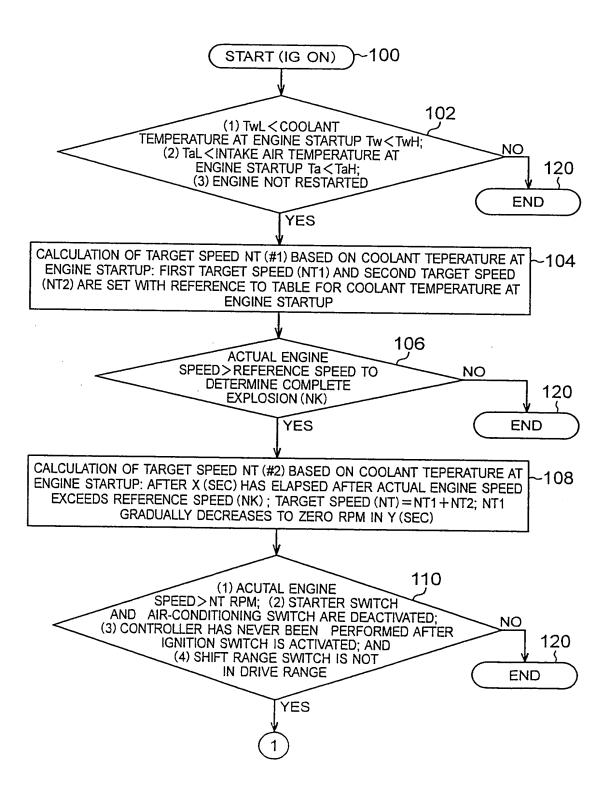2/6

FIG. 3

START (IG ON) ~100

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(1) TwL < COOLANT TEMPERATURE AT ENGINE STARTUP Tw < TwH;
(2) TaL < INTAKE AIR TEMPERATURE AT ENGINE STARTUP Ta < TaH;
(3) ENGINE NOT RESTARTED

NO → 120 END

YES

CALCULATION OF TARGET SPEED NT (#1) BASED ON COOLANT TEPERATURE AT ENGINE STARTUP: FIRST TARGET SPEED (NT1) AND SECOND TARGET SPEED (NT2) ARE SET WITH REFERENCE TO TABLE FOR COOLANT TEMPERATURE AT ENGINE STARTUP ~104

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ACTUAL ENGINE SPEED > REFERENCE SPEED TO DETERMINE COMPLETE EXPLOSION (NK)

NO → 120 END

YES

CALCULATION OF TARGET SPEED NT (#2) BASED ON COOLANT TEPERATURE AT ENGINE STARTUP: AFTER X (SEC) HAS ELAPSED AFTER ACTUAL ENGINE SPEED EXCEEDS REFERENCE SPEED (NK); TARGET SPEED (NT) = NT1 + NT2; NT1 GRADUALLY DECREASES TO ZERO RPM IN Y (SEC) ~108

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(1) ACUTAL ENGINE SPEED > NT RPM; (2) STARTER SWITCH AND AIR-CONDITIONING SWITCH ARE DEACTIVATED;
(3) CONTROLLER HAS NEVER BEEN PERFORMED AFTER IGNITION SWITCH IS ACTIVATED; AND
(4) SHIFT RANGE SWITCH IS NOT IN DRIVE RANGE

NO → 120 END

YES

①

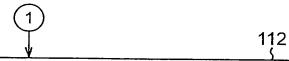Title: CONTROLLER FOR CONTROL AT ENGINE STARTUP
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FIG. 4

(1)

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ISC FLOW RATE AT ENGINE STARTUP, CONTROL FOR ISCFST:
QAFST1 (Tw) AND QAFST2 (Tw) ARE BYPASS AIR QUANTITY FOR CORRECTION
(#1, #2, RESPECTIVELY) AFTER ACTUAL ENGINE SPEED NE EXCEEDS REFERENCE
SPEED NK (SET ACCORDING TO TABLE FOR COOLANT TEMPERATURE AT ENGINE
STARTUP); TQAFST1, TQAFST2, TQAFST3, ARE BYPASS AIR QUANTITY
CORRECTING TIME (#1, #2, #3, RESPECTIVELY) AFTER ACTUAL ENGINE SPEED
NE EXCEEDS REFERENCE SPEED NK;
ISCFST = QAFST1 (Tw) LITER AFTER ACTUAL ENGINE SPEED NE EXCEEDS
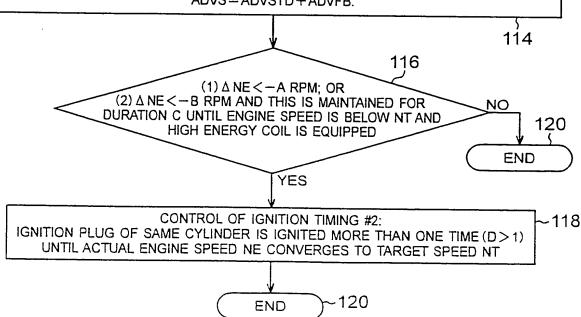REFERENCE SPEED NK AND AFTER TQAFST1 HAS ELAPSED;
ISCFST = QAFST2 (Tw) LITER AFTER ACTUAL ENGINE SPEED NE EXCEEDS
REFERENCE SPEED NK AND AFTER TQAFST2 HAS ELAPSED;
ISCFST = 0 LITER AFTER ACTUAL ENGINE SPEED NE EXCEEDS REFERENCE SPEED
NK AND AFTER TQAFST3 HAS ELAPSED;
FEEDBACK CORRECTION OF BYPASS AIR QUANTITY ISCFST WITH RESPECT TO
ENGINE SPEED BECOMES ZERO LITER;
QISC (TOTAL VOLUME OF BYPASS AIR) = ISCTW (TOTAL VOLUME OF FLOW) + ISCFST;
AND ISCFST IS SET ABOVE 120 LITER FOR EACH CYLINDER.

CONTROL OF IGNITION TIMING #1:
ADVS IS FINAL IGNITION TIMING; ADVSTD IS BASE IGNITION TIMING; AND
ADVFB IS IGNITION TIMING CORRECTED BY ENGINE SPEED FEEDBACK;
ΔNE = ACTUAL ENGINE SPEED NE − TARGET ENGINE SPEED NT;
Kp IS PROPORTIONAL CORRECTION FACTOR; Ki IS INTEGRAL CORRECTION
FACTOR GAIN; I IS INTEGRAL CORRECTION FACTOR (I = Σ Ki; INTEGRATED
FOR EACH IGNITION UNTIL ENGINE SPEED IS ABOVE NT); Ki IS INTEGRAL
CORRECTION FACTOR GAIN (KiP = POSITIVE GAIN WHILE ΔNE < 0, AND Kim =
NEGATIVE GAIN WHILE ΔNE > 0); AND
ADVS = ADVSTD + ADVFB.

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(1) ΔNE < −A RPM; OR
(2) ΔNE < −B RPM AND THIS IS MAINTAINED FOR
DURATION C UNTIL ENGINE SPEED IS BELOW NT AND
HIGH ENERGY COIL IS EQUIPPED

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NO → **120** END

YES

CONTROL OF IGNITION TIMING #2:
IGNITION PLUG OF SAME CYLINDER IS IGNITED MORE THAN ONE TIME (D > 1)
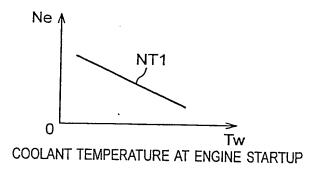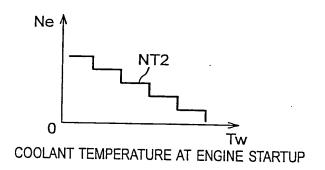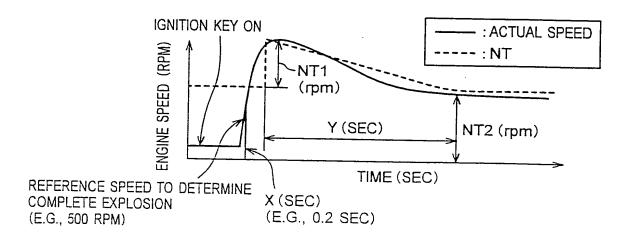UNTIL ACTUAL ENGINE SPEED NE CONVERGES TO TARGET SPEED NT

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END **120**

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FIG. 5

Ne

NT1

0

Tw

COOLANT TEMPERATURE AT ENGINE STARTUP

FIG. 6

Ne

NT2

0

Tw

COOLANT TEMPERATURE AT ENGINE STARTUP

FIG. 7

IGNITION KEY ON

ENGINE SPEED (RPM)

———— : ACTUAL SPEED
- - - - : NT

NT1
(rpm)

Y (SEC)

NT2 (rpm)

TIME (SEC)

REFERENCE SPEED TO DETERMINE
COMPLETE EXPLOSION
(E.G., 500 RPM)

X (SEC)
(E.G., 0.2 SEC)

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FIG. 8

FIG. 9

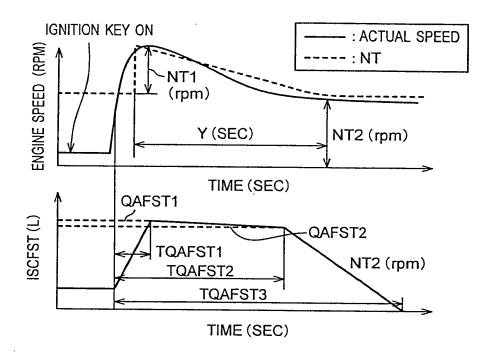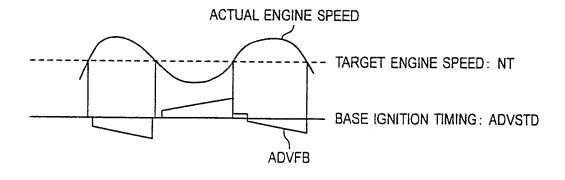Title: CONTROLLER FOR CONTROL AT ENGINE STARTUP
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FIG. 10

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